

Factors Influencing the Adoption of E-Commerce Technology by the Small and Medium Enterprises: Their E-Commerce Experience

Vasin Chooprayoon¹ and Chun Che Fung²
School of Information Technology, Murdoch University
South Street, Murdoch, Perth, Western Australia 6150
¹v.chooprayoon@murdoch.edu.au
²l.fung@murdoch.edu.au

Abstract—The objective of this paper is to investigate the factors which have influences on the adoption of electronic commerce technology (ECT) by small and medium enterprises (SMEs) operating in Bangkok, Thailand. The e-commerce experiences of the SMEs are used as the predictors of the attitude and level towards the adoption. The finding showed that there were slight influences towards the ECT adoption due to four main factors: business environment, knowledge, organisation, and technology.

I. INTRODUCTION

This paper reports a study based on quantitative approaches in the determination of the factors influencing the adoption of E-commerce technology by the small and medium enterprises (SMEs) in Thailand. Relevant models are examined and verified in this study in order to assess the applicability of such models from the perspective of Thailand. In 2002, the Thai government has endorsed an information technology policy framework entitled “**Thailand Vision towards a Knowledge-Based Economy (IT 2010)**”. The policy framework has been implemented and is expected to be followed through until 2010. The IT 2010 policy emphasises the roles of information technology for the enablement and facilitation of economic and social development. The five areas of information technology development highlighted in the policy are e-government, e-industry, e-commerce, e-education, and e-society. In addition, the policy framework also aims to develop the information technology industry in Thailand [1].

E-commerce is acknowledged by the Thai government that it has the ability to increase business opportunities, decrease transaction costs, augment competence, improve the quality of life, and assist SMEs to exploit new opportunities in the new global economy [2]. Jutla, Bodorik and Dhaliwal[3] stated in order to develop a country, government’s support for e-business in SMEs is an important ingredient for the development. Therefore, the government has to develop precise policies and relevant laws on issues such as transactions, authentication, certification, security, deception, and consumer right. The other important aspects are issues related to ICT facilitation, finance, transaction of commercial entities, and encouragement of confidence in e-commerce use. Out of the above, one of the government’s objectives is to develop the ability of Thai entrepreneurs to compete with other countries in the world market. The emphasis is placed on e-commerce for export, trade, services, and domestic consumption. As

regard to IT 2010, the government has already set policies (the ‘E-Commerce Policy Framework’) for developing e-commerce in Thailand [1].

At present, many Thai businesses have started using Internet technology and e-commerce applications to promote their products and services to customers all over the world directly. Smith [4] indicated that SMEs’ demand is the ICT implementation for competitiveness, entrepreneurial confidence, and acceptance from customers. In addition, he suggested SMEs should invest in ICTs, improve skills in the use of ICTs, and develop consumer security systems. Moreover, creative promotion, ease of use and simple functions are highly demanded in SMEs e-commerce systems[5].

The Electronic Commerce Resource Centre (ECRC) of Thailand [6] stated that the barriers of e-commerce entrepreneurship in Thailand are two aspects: *customers’ problems* and *technical problems*.

In addition to the above challenges, the main factors that affect e-commerce development in Thailand are the entrepreneurs and business owners. This is due to their lack of precise understanding and their inability to apply ECT to improve their business performance and operations. The effort to overcome this barrier therefore forms the main motivation of this study.

In summary, business environments in Thailand still need to overcome barriers for sustainable progress of electronic commerce. This includes *low consumer confidence* in electronic commerce [7], *non-collaboration* amongst business and industrial sectors, and the *lack of entrepreneurs’ comprehension* with regard to e-commerce possibilities and benefits [8]. Therefore, it is fair to say that the Thai SME sector is only beginning to trot on a pathway to join the global business market. However, the Thai e-commerce framework and its implementation in the SME sector are still lingering in the development stage. It is the intention of this study that an in depth understanding of the drivers and their influences will be achieved. This will help to propel Thai’s SME sector to a new level of success.

II. RESEARCH FRAMEWORK

This study is based on the combination of a variety of approaches and theoretical frameworks, which are listed as follows: a) Diffusion of Innovation Model [9, 10], b) Technology Acceptance Model (TAM) [11-20], c) Theory of Reasoned Action (TRA)/Theory of Planned Behaviour (TPB) [21-25], d) Social Cognitive Theory (SCT) [26-

34], and e) Unified Theory of Acceptance and Use of Technology (UTAUT) [11-13, 35, 36].

Based on the aforementioned aspects, the research model was developed as shown in Figure 1.

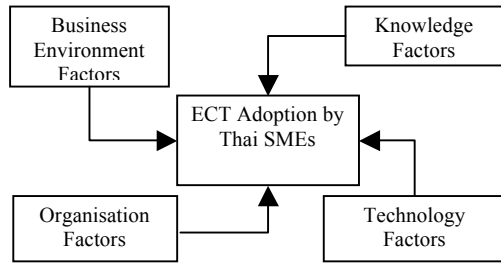


Fig. 1. Factors Influencing ECT Adoption by Thai SMEs

TABLE 1
FACTOR DESCRIPTIONS

Factor Name	Factor Description
Environment Factors	
Competitive Pressure	Competitive pressure from other Internet adoption within my industry
Government	Government rules and regulations
Market	Viable market or customer base e-commerce
Partners/Vendors	Availability of the right partners with whom to work
Supplier Readiness	Readiness of Suppliers for electronic business
Knowledge Factors	
Change Experience	Employee experience with making major changes
Executive Experience	Experience of top executives with computers and the Internet
Innovativeness	Your company's willingness to about new technology
Models	Models of successful use in my industry
Need	Perceived need for change or implementation of Web and Internet Technology
Prior Experience	The company's prior experience with new technology implementations
Trust	Trust or confidence in Web and Internet Technology
Understanding	Understanding of available opportunities and options with e-commerce
Value	Perceived value or relevance to the business
Organisational Factors	
Capital	Access to capital for start-up
Employee Reduction	Resulting reduction in number of employees
Priority	Priority relative to other project that require existing resource and time
Profitability	Projected profitability of e-commerce
Technical Expertise	Availability of technical staff or consultants with web-skills
Technological Factors	
Cost	Cost of setup and maintain
E-commerce Technology	Technology for selling products or service online
Infrastructure	Access to network services or infrastructure to support Web and Internet Technology
Reliability	Reliability of Web and Internet Technology
Security	Security issues
Technology Availability	Availability or adequacy of existing technology and tools
Other	Other

Figure 1 draws the four main factors, which are hypothesised to influence the adoption of ECT by Thai SMEs. The factors are business environment, knowledge, organisation, and technology. In additional, some SMEs' background is designed as supporting factors such as the

number of employees, number of years in business, e-commerce experience, gender of SMEs' owners who responded to the questionnaires etc. are included in the model. The inserted variables are used to study whether these background factors differ significantly on the influence. The following table shows the variable definitions based on the work by Wymer and Regan [37].

Table 1 shows the main variables in details. These variables were used for designing the items in the questionnaire for gathering data from the SMEs located in Bangkok and the provinces around.

Based on the model, the following four hypotheses are proposed:

- H₁: business environment factors influence the ECT adoption when measured by e-commerce experiences of the SMEs
- H₂: knowledge factors influence the ECT adoption when measured by e-commerce experiences of the SMEs
- H₃: organisation factors influence the ECT adoption when measured by e-commerce experiences of the SMEs
- H₄: technology factors influence the ECT adoption when measured by e-commerce of the SMEs

III. RESEARCH METHODOLOGY

A. Samples and Demographic Distribution

The target population is composed of 845,064 SMEs entrepreneurs in Thailand; however, the study focuses on retailing SMEs entrepreneurs which are 30% of the total of SMEs firms (259,310 retailing firms) [38].

The sample size of the population was drawn from the sample size estimation formula proposed by Taro Yamane [39]. The sample size was defined at the degree of the precision level at $\pm 5\%$ where confidence level is 95 %. By this, 400 firms were used as representative samples for the retailing SMEs located in Bangkok and surrounding areas in Thailand.

B. Research Tool

The research tools used in this study are questionnaires, which were designed and developed from the research model shown in Figure 1. The questionnaires were translated into Thai and twenty copies of the questionnaires were sent to the SMEs in order to carry out a pre-test. The pre-test results show that the participants understood the questions, the scales in use, and the general instructions.

C. Data Analysis

SPSS application and appropriate statistical techniques were used to process the data from the returned questionnaires. Statistic Scales of Measurements used are frequency distribution, percentage, arithmetic mean, standard deviation, and regression.

The scale lengths for measuring level of influence of factors and customer behaviours towards ECT adoption by Thai SMEs are composed of the following seven levels from 3.00, which represented extremely likely influence to 1.00, which represented extremely unlikely influence

IV. FINDINGS

A. Descriptive Statistic Results

209 SMEs (52.25%) returned the questionnaires from the distribution of 400 questionnaires. It found that almost all SMEs (149) have used or implemented ECT in their business (71.98%) and only 58 SMEs have never used or implemented ECT in their business (40.49%).

This section presents the results from the analysis of the descriptive statistics measuring the four factors, which influence the adoption of ECT by Thai SMEs. The measurement based on the mean and standard deviation. Table 2 to 5 present the results and interpretation.

TABLE 2
INFLUENCE LEVELS OF BUSINESS ENVIRONMENT FACTORS

Business Environment	Mean	SD.	Interpretation
1. Your business competitors have implemented the Internet technology and have access to technical personnel and specialists in Web and the Internet technology	1.46	1.27	quite likely
2. Government policies on the e-commerce and the Master Plan – “Thailand Vision Towards a Knowledge-Based Economy (IT2010)” and the related rules and regulations	1.46	1.29	quite likely
3. Continual increasing availability of online access by the population in both urban and rural urban areas	1.91	1.28	quite likely
4. Adoption of ECT by business partners	1.27	1.33	quite likely
5. Readiness of suppliers for electronic business	0.96	1.44	slightly likely
Total	1.42	.88	quite likely

Table 2 shows the mean and standard deviation of influence level of business environment factors, which effect the ECT adoption by the SMEs. Totally, these factors influence the adoption quite likely at the average rating of 1.42. There is only one sub-factor, “*readiness of suppliers for e-business*”, received the lowest rating scale at 0.96—it means that this sub-factor is likely to influence the adoption of ECT slightly. There are four sub-factors influence the adoption of ECT by the SMEs at quite likely scale (1.91, 1.46, and 1.24).

TABLE 3
INFLUENCE LEVELS OF KNOWLEDGE FACTORS

Knowledge Factors	Mean	SD.	Interpretation
1. Your employee has prior experience or involvement with the process of changing from traditional business to online business	1.28	1.34	quite likely
2. The managers in your organization have experience with ICTs	1.73	1.04	quite likely
3. You are enthusiastic to adopt and experiment with new and innovative technology	1.89	1.20	quite likely
4. There are models of successful use in other companies in your industry sector.	1.07	1.41	quite likely
5. Perceived need to change and implement ECT - Web and Internet technology	2.10	1.06	extremely likely
6. Your company has prior experiences with new technology implementation	1.73	1.02	quite likely
7. You have trust and confidence in ECT	1.82	1.31	quite likely
8. Your understanding of the available opportunities and options with ECT	1.81	1.20	quite likely
9. Your perceived value or relevance of ECT with respect to the business	1.85	1.18	quite likely
10. Adequacy and variety of information resources on ECT	1.78	1.34	quite likely

Knowledge Factors	Mean	SD.	Interpretation
11. Adequacy and variety of communication channels for the implementation of ECT	2.24	0.94	extremely likely
12. Need for frequent communication between your firm and your trading partners	1.31	1.43	quite likely
Total	1.68	.80	quite likely

Table 3 shows that the descriptive statistic which derived the mean and standard deviation of the 12 sub-factors of the knowledge factor. On the whole, the knowledge factors influence the adoption of ECT at quite likely scale (1.68). There are two sub-factors, which received the highest influence to the ECT adoption at the average rating scale 2.24 and 2.10 in ascending order. It is fair to mention that the two sub-factors influence the adoption at the level of extremely likely.

TABLE 4
INFLUENCE LEVELS OF ORGANISATION FACTORS

Organisation Factors	Mean	SD.	Interpretation
1. Availability of capital for starting-up e-commerce systems	1.58	1.16	quite likely
2. Reduction in the number of employees by implementing e-commerce systems	0.57	1.76	likely slightly
3. Perceived higher priority of the e-commerce project over other project that require existing resource and time	1.62	1.35	quite likely
4. Management support for setting up and implementing e-commerce systems	1.83	1.29	quite likely
5. Contribution by government, professional or business associations (e.g. Office of SME) in raising the awareness and facilitating the implementation of ECT	1.81	1.21	quite likely
Total	1.48	.76	quite likely

In Table 4, almost all organization sub-factors influence the ECT adoption by the SMEs at the quite likely scale between average rating of 1.58 and 1.83. However, as a group, the organization factors influence the adoption at the quite likely scale 1.48.

TABLE 5
INFLUENCE LEVELS OF TECHNOLOGY FACTORS

Technology Factors	Mean	SD.	Interpretation
1. Cost for setting-up, installing and maintaining the e-commerce systems	1.49	1.14	quite likely
2. Advancement of ECT which enables the selling of products and servicing online customers	2.04	1.18	extremely likely
3. Availability of Internet and E-commerce infrastructure such as wired or wireless communication, bandwidth, network service, gateway and Internet service provider	1.83	1.27	quite likely
4. Availability and adequacy of existing ECT and tools	1.71	1.25	quite likely
5. Complexity and intricacy of ECT	0.95	1.68	Slightly likely
Total	1.60	.85	quite likely

In Table 5, the sub-factor of the technology factors, “advancement of ECT which enables the selling of products and servicing online customers,” received the highest average rating scale at 2.04. It means that this sub-factor influence ECT adoption by the SMEs at likely extremely level. Entirely, the technology factors influence the adoption at the quite likely scale 1.60.

B. Regression Analysis

In this section, the regression techniques designed to select the most important value for prediction of dependent variable is the “enter” method. By this method, the e-commerce or the Internet experiences of 149 SMEs (72%) become the biggest groups of the entire SMEs chosen as variables for the measurement. The followings are the test results shown in Table 6 to 9.

H₁: business environment factors influence the ECT adoption when measured by e-commerce experiences of the SMEs

TABLE 6
COEFFICIENTS OF BUSINESS ENVIRONMENT FACTORS INFLUENCE THE ECT ADOPTION OF THAI SMEs MEASURED BY E-COMMERCE EXPERIENCES

Model	Business Environment Factors	Unstd. Coeff.		Std. Coeff.		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	.931	.066			14.189	.000
	1. Your business competitors have implemented the Internet technology and have access to technical personnel and specialists in Web and the Internet technology	-.020	.028	-.057		-.708	.480
	2. Government policies on the e-commerce and the Master Plan – “Thailand Vision Towards a Knowledge Based Economy (IT2010)” and the related rules and regulations	-.032	.025	-.092		-1.255	.211
	3. Continual increasing availability of online access by the population in both urban and rural urban areas	-.035	.025	-.101		-1.419	.158
	4. Adoption of ECT by business partners	-.021	.029	-.063		-.733	.464
	5. Readiness of suppliers for electronic business	-.038	.028	-.121		-1.333	.184
R		.29					
R Square		.084					
Adjusted R Square		.061					
F		3.653					
Sig.		.003					

In Table 6, value of R Square is close to 1 at .084. It indicates that business environment factors are able to influence the ECT adoption by Thai SMEs at 8.4% with statistical significance. The hypothesis test returned the result that the coefficients of the business environment factors have linear correlation with the e-commerce experiences. The hypothesis test showed that H₁ is accepted as significant value is less than 0.05 (sig.value = .003).

H₂: knowledge factors influence the ECT adoption when measured by e-commerce experiences of SMEs

TABLE 7
COEFFICIENTS OF KNOWLEDGE FACTORS INFLUENCE THE ECT ADOPTION OF THAI SMEs MEASURED BY E-COMMERCE EXPERIENCES

Model	Knowledge Factors	Unstd. Coeff.		Std. Coeff.		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	.478	.154			3.113	.002
	1. Your employee has prior experience or involvement with the process of changing from traditional business to online business	.030	.043	.066		.686	.494
	2. The managers in your organization have experience with ICTs	-.036	.057	-.060		-.637	.525
	3. You are enthusiastic to adopt and experiment with new and innovative technology	-.037	.060	-.079		-.609	.544
	4. There are models of successful use in other companies in your industry sector	-.007	.032	-.021		-.225	.822
	5. Perceived need to change and implement ECT - Web and Internet technology	.207	.067	.328		3.103	.002
	6. Your company has prior experiences with new technology implementation	.028	.057	.053		.501	.617
	7. You have trust and confidence in ECT	-.119	.053	-.270		-2.230	.027
	8. Your understanding of the available opportunities and options with ECT	-.096	.052	-.207		-1.861	.065
	9. Your perceived value or relevance of ECT with respect to the business	-.014	.067	-.027		-.217	.828
	10. Adequacy and variety of information resources on ECT	.018	.059	.035		.304	.762
	11. Adequacy and variety of communication channels for the implementation of ECT	.110	.057	.211		1.944	.054
	12. Need for frequent communication between your firm and your trading partners	-.062	.033	-.184		-1.896	.060
R		.43					
R Square		.185					
Adjusted R Square		.112					
F		2.519					
Sig.		.005					

In Table 7, value of R Square is close to 1 at .185. It points that knowledge factors influence the ECT adoption by Thai SMEs at 18.5% with statistical significance. The test of hypothesis produced coefficients of the knowledge factors, which have linear correlation with the e-commerce experiences. The test shown that H₂ is accepted as significant value is less than 0.05 (sig.value = .005).

H₃: Has linear correlation between organisation factors and ECT adoption when measured by e-commerce experiences of the SMEs

TABLE 8
COEFFICIENTS OF ORGANISATION FACTORS INFLUENCE THE ECT
ADOPTION OF THAI SMES MEASURED BY E-COMMERCE EXPERIENCES

Model	Organisation Factors	Unstd. Coeff.		Std. Coeff	T	Sig.
		B	Std. Error	Beta		
	(Constant)	.950	.069		13.851	.000
	1. Availability of capital for starting-up e-commerce systems	-.018	.028	-.045	-.621	.535
	2. Reduction in the number of employees by implementing e-commerce systems	-.053	.019	-.206	-2.814	.005
	3. Perceived higher priority of the e-commerce project over other project that require existing resource and time	-.026	.030	-.077	-.865	.388
	4. Management support for setting up and implementing e-commerce systems	-.037	.033	-.108	-1.143	.254
	5. Contribution by government, professional or business associations (e.g. Office of SME) in raising the awareness and facilitating the implementation of ECT	-.036	.029	-.097	-1.230	.220
	R	.296				
	R Square	.088				
	Adjusted R Square	.065				
	F	3.836				
	Sig.	.002				

In Table 8, value of R Square is close to 1 at .088. It indicates that organisation factors influence the ECT adoption by Thai SMEs at 8.8% with statistical significance. The two-tail test of hypothesis produced coefficients of the organisation factors, which have linear correlation with the e-commerce experiences. The hypothesis test shown that H_3 is accepted as the significant value is less than 0.05 (sig.value = .002).

H_4 : Has linear correlation between technology factors and ECT adoption when measured by e-commerce experiences of the SMEs

TABLE 9
COEFFICIENTS OF TECHNOLOGY FACTORS INFLUENCE THE ECT
ADOPTION OF THAI SMES MEASURED BY E-COMMERCE EXPERIENCES

Model	Technology Factors	Unstd. Coeff.		Std. Coeff	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.953	.066		14.436	.000
	1. Cost for setting-up, installing and maintaining the e-commerce systems	-.083	.031	-.209	-2.640	.009
	2. Advancement of ECT, which enables the selling of products and servicing online customers	.031	.032	.081	.962	.337
	3. Availability of Internet and E-commerce infrastructure such as wired or wireless communication, bandwidth, network service, gateway and Internet service provider	-.022	.031	-.062	-.697	.487
	4. Availability and	-.056	.031	-.157	-1.796	.074

Model	Technology Factors	Unstd. Coeff.		Std. Coeff	t	Sig.
		B	Std. Error	Beta		
	adequacy of existing ECT and tools					
	5. Complexity and intricacy of ECT	-.040	.019	-.150	-2.116	.036
	R	.356				
	R Square	.126				
	Adjusted R Square	.105				
	F	5.822				
	Sig.	.000				

In Table 9, the value of R Square is close to 1 at .126. It implies that technology factors influence the ECT adoption by Thai SMEs at 12.6% with statistical significance. The test of hypothesis revealed coefficients of the technology factors, which have linear correlation with the e-commerce experiences. The hypothesis test shown that H_4 is accepted as significant value is less than 0.05 (sig.value = .000).

In summary, the four hypotheses are accepted with the statistic significant. The Figure 2 shows the comparative hypothesis test:

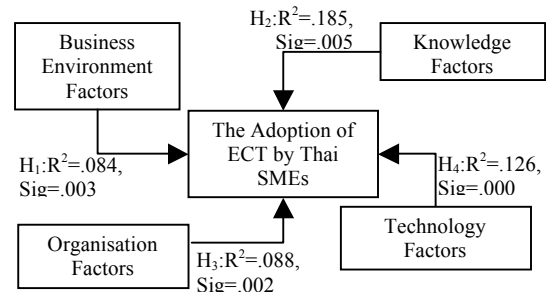


Fig.2. The Comparative Hypothesis Test

Figure 2 shows that knowledge factors have influenced the adoption of ECT by the Thai SMEs at the highest scale as $R^2=18.5\%$ and sig.value=.005. Followed by the technology factors at the second highest influence ($R^2=12.6\%$, sig.value=.000), organisation factors at $R^2=8.8\%$ and sig.value=.002, and business environment factors at $R^2=8.4\%$ and sig.value=.003, in ascending order.

V. CONCLUSION

There are four factors influencing the adoption of ECT by the SMEs. The first factor, *business environment*, influences the adoption quite likely at the average rating of 1.42. The second factor, *knowledge*, influences the adoption of ECT at quite likely scale (1.68). The third factor, *organization*, influences the ECT adoption at the quite likely scale between average rating 1.58 and 1.83. Moreover, the fourth factor, *technology*, influences the adoption at quite likely scale 1.60. The four hypotheses are tested by regression analysis. The results show that the SMEs, which have e-commerce experiences, were influenced by the four factors with statistical significance. The test indicated coefficients of the factors have linear correlation with the e-commerce experiences.

From the study, related organisations or institutions should pay attention on how to improve the factors related

to the best practices. For example, business environment factors that affect to the adoption are able to bring the SMEs to the arena of efficient competition in both domestic and international market. The Thai government should have an annual study of the business environment factors; consequently, publicize the study results to the SMEs in order to encourage and stimulate them to adopt the ECT because of their competitors are already advancing in this important area. In term of technology factors, contribution from the government for helping the SMEs invest in the ECT themselves is an important role. Hence, the government and organisations such as SMEs, banks and related units should foster a close relationship with the SMEs in all aspects: funding, consulting, marketing, free software developing, providing sufficient e-commerce infrastructure, etc. It is believed that this will bring great benefits to the SMEs and to Thailand.

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